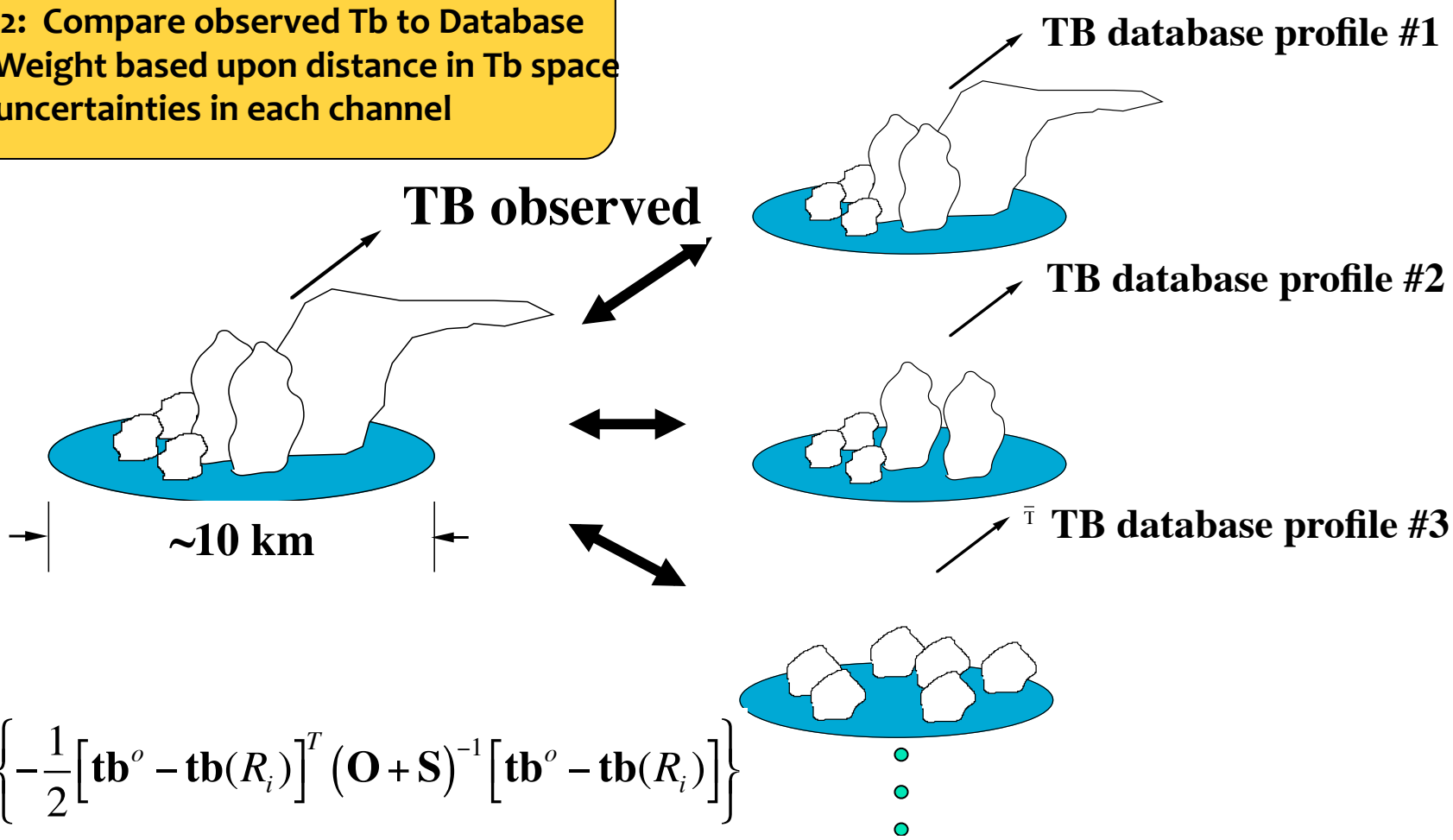
GPM Radiometer Algorithm

From GPROF V1.4 to V2.0

The GPM radiometer algorithm

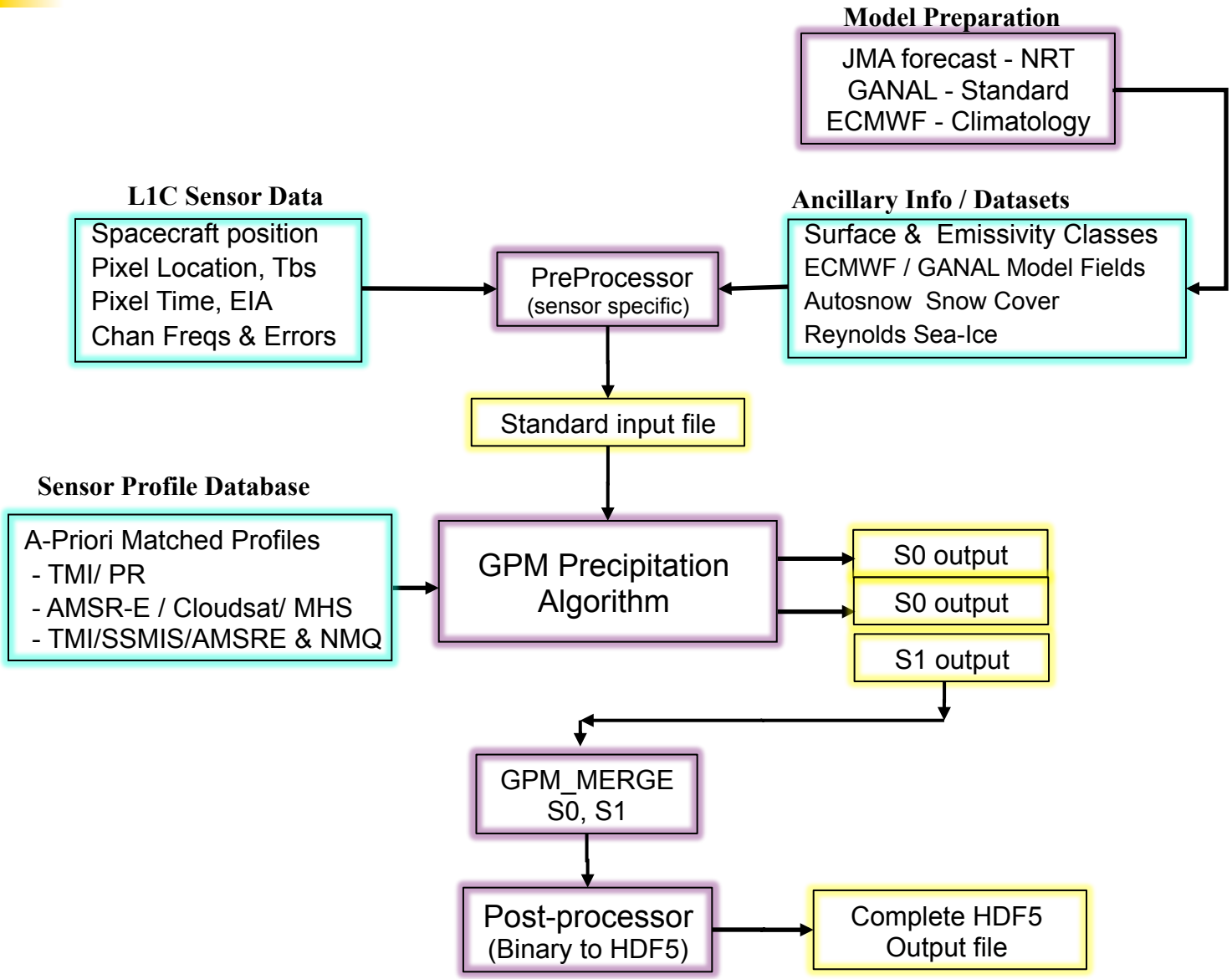
Step 1: Use Satellite to derive set of "Observed" profiles that define an a-priori database of possible rain structures.

Step2: Compare observed Tb to Database Tb. Weight based upon distance in Tb space and uncertainties in each channel

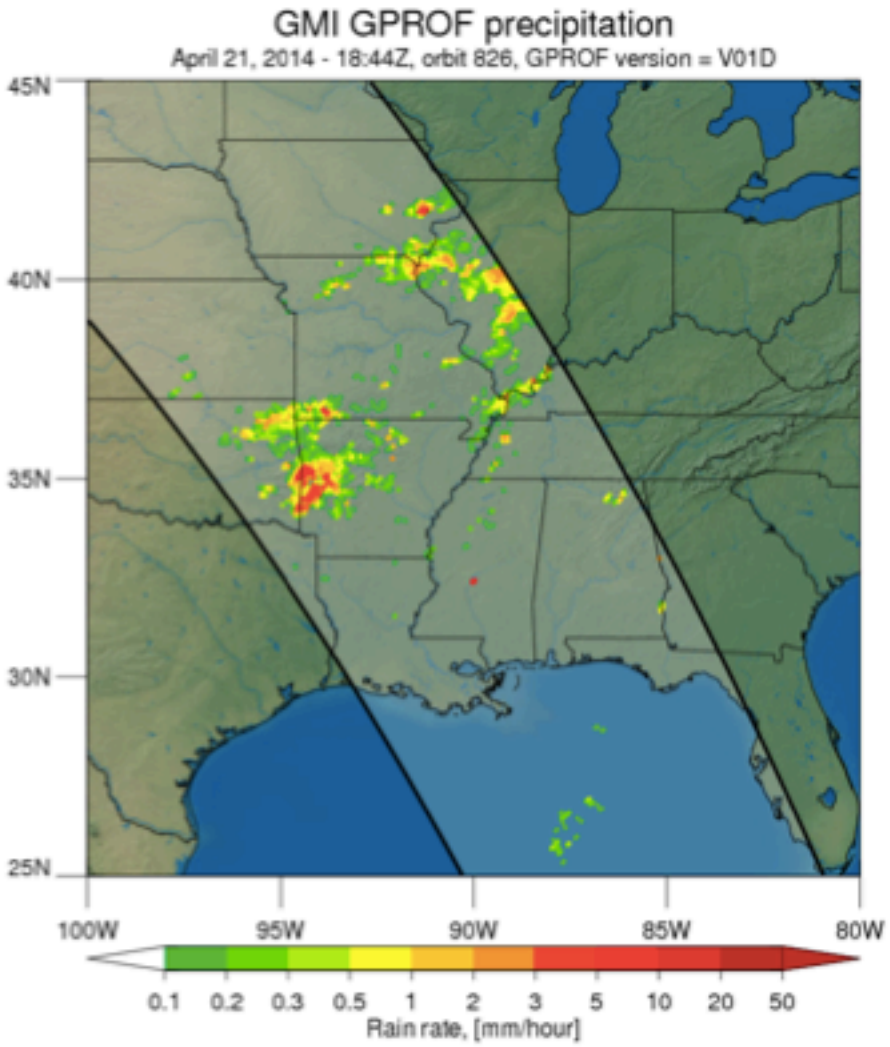


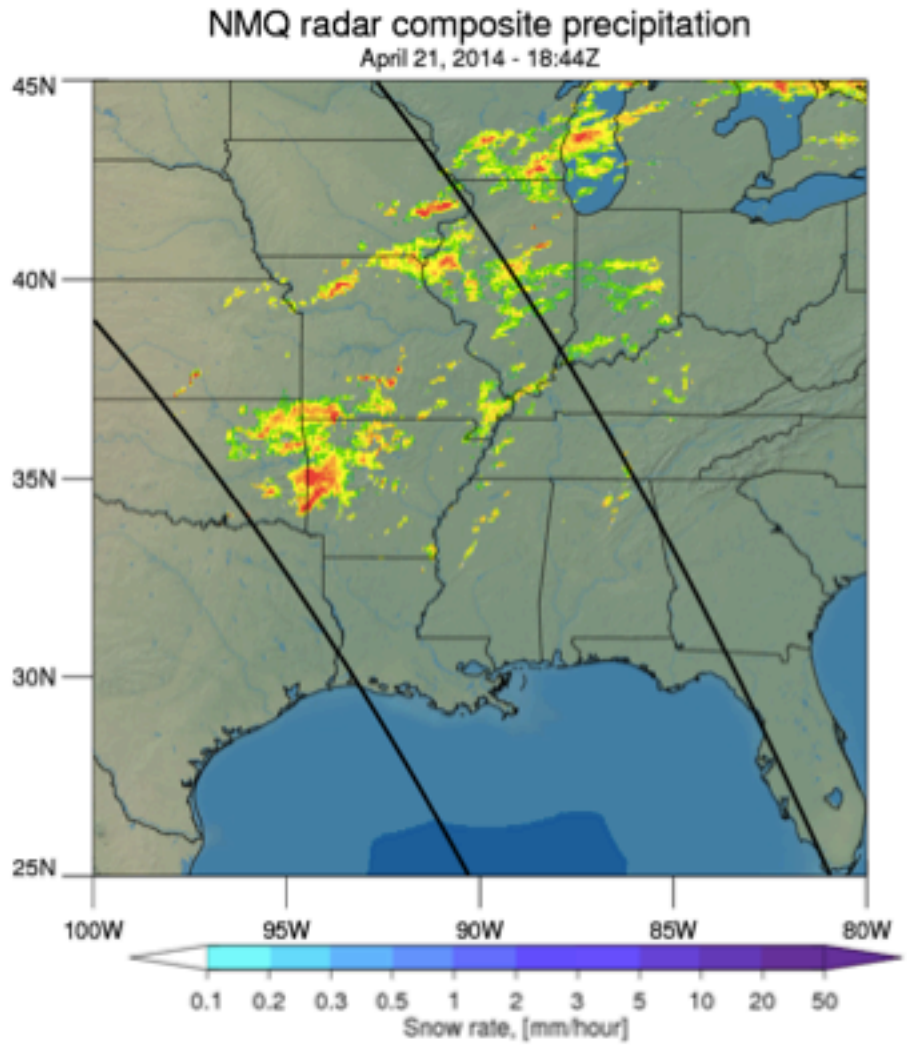
$$J_i = \exp\left\{-\frac{1}{2}\left[\mathbf{tb}^o - \mathbf{tb}(R_i)\right]^T \left(\mathbf{O}+\mathbf{S}\right)^{-1}\left[\mathbf{tb}^o - \mathbf{tb}(R_i)\right]\right\}$$

GPROF 2014 Algorithm Structure

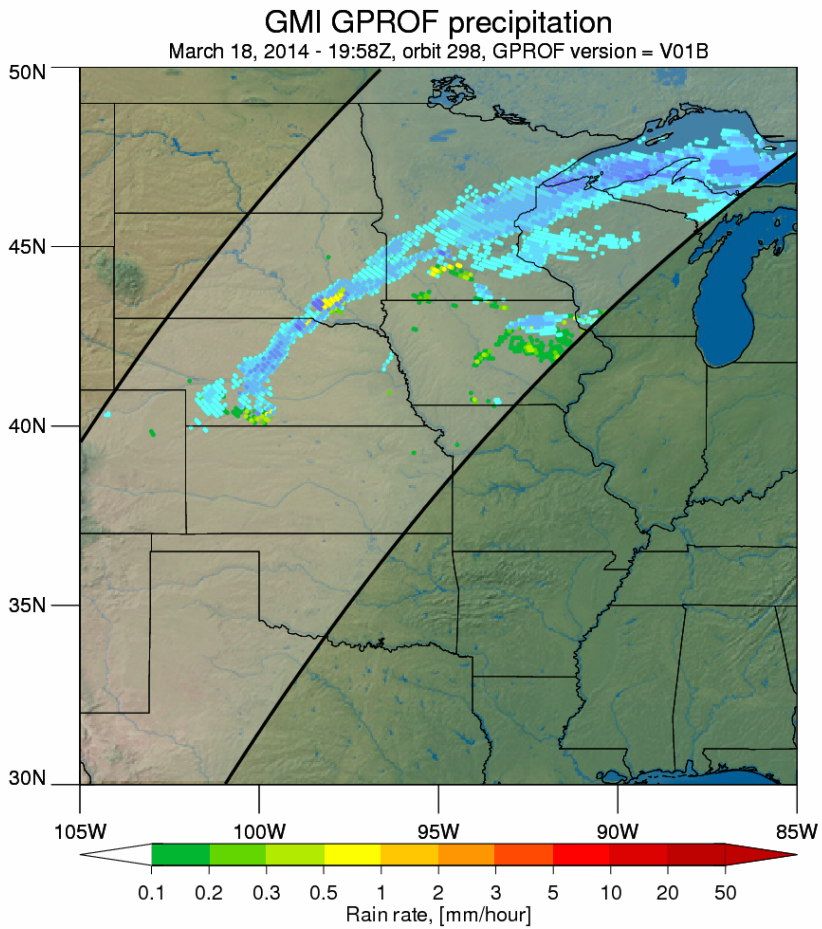


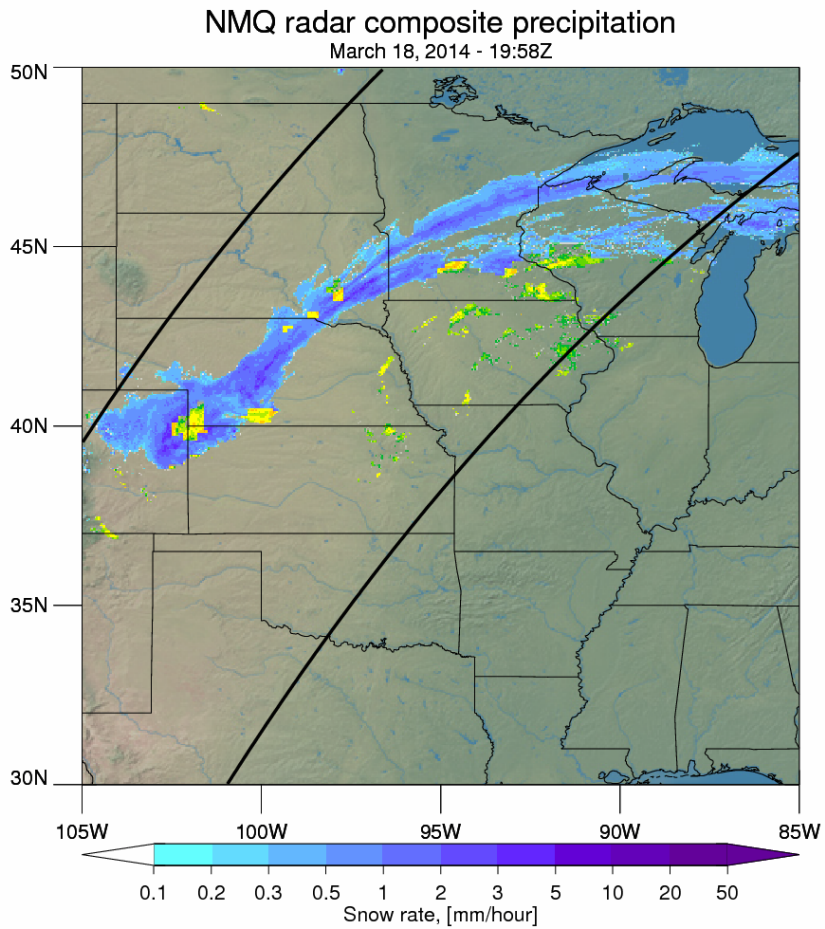
GPROF 2014 V1.4 vs MRMS



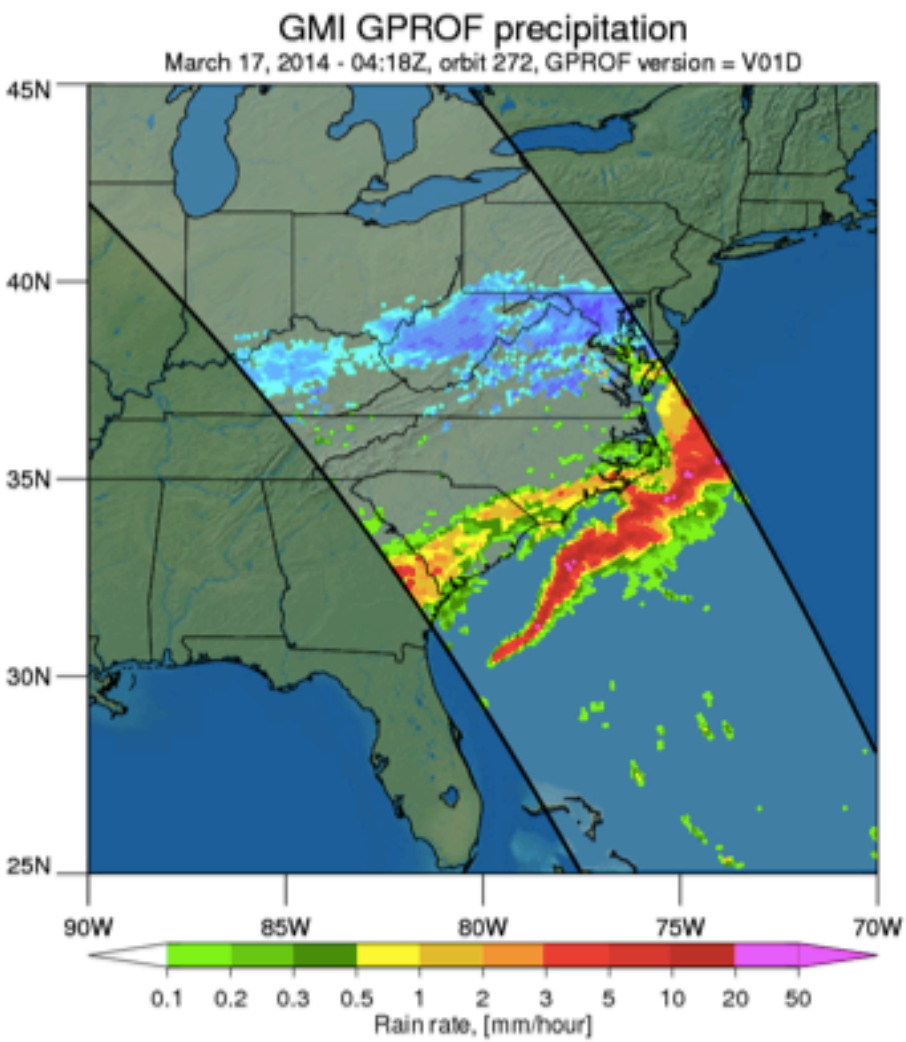


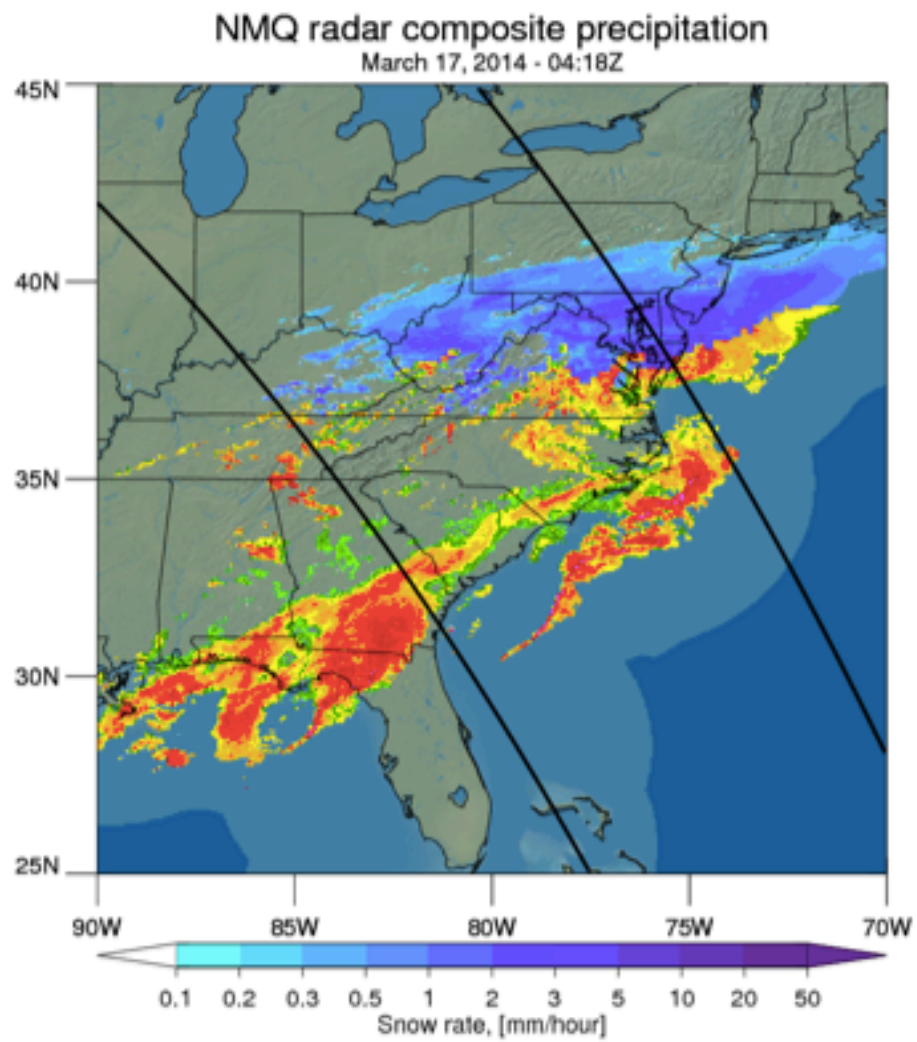
GPROF 2014 V1.4 vs MRMS



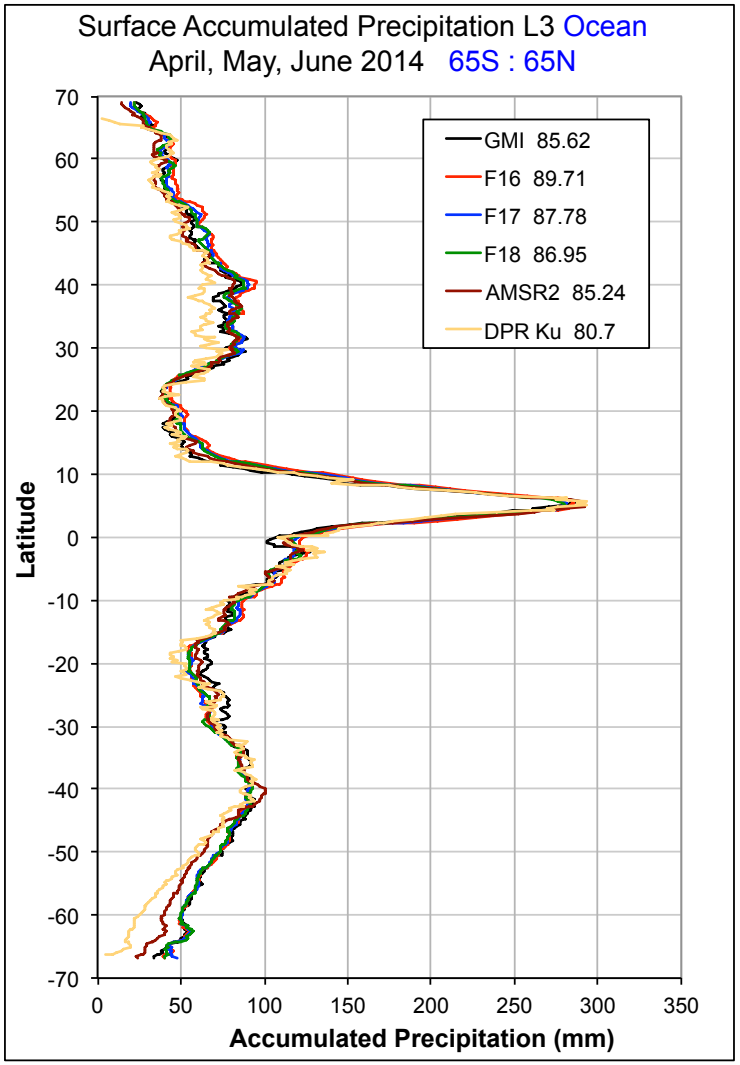


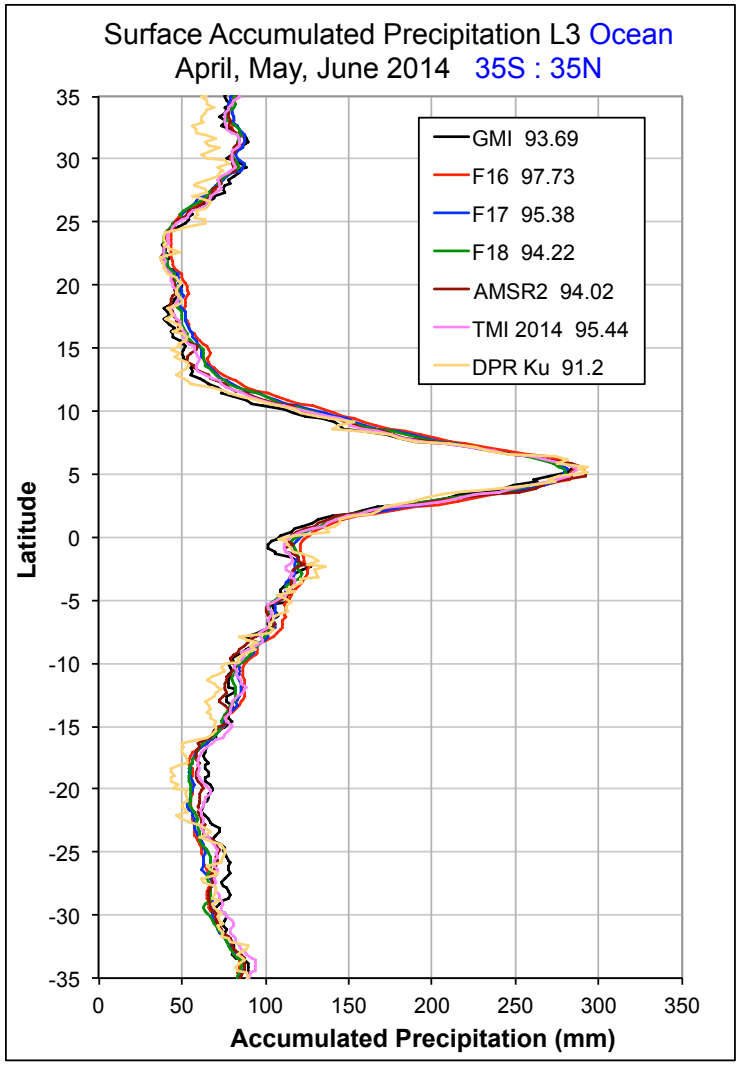
GPROF 2014 V1.4 vs MRMS





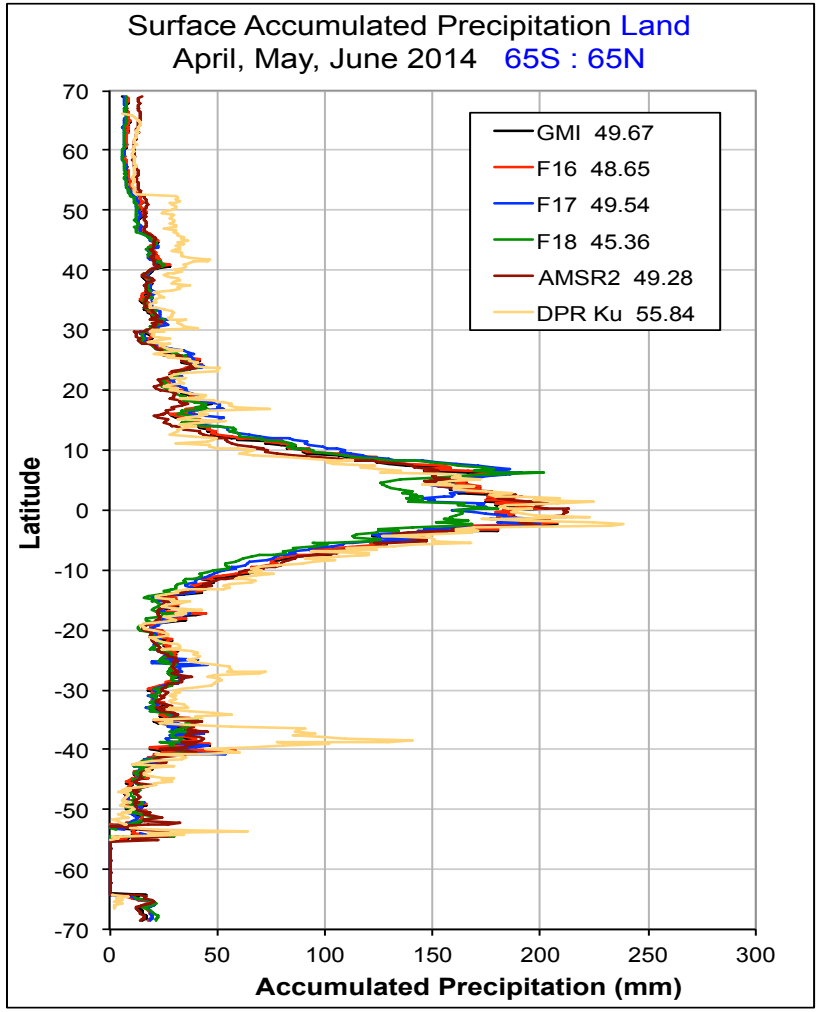
GPROF V1.4
Zonal Means - Ocean



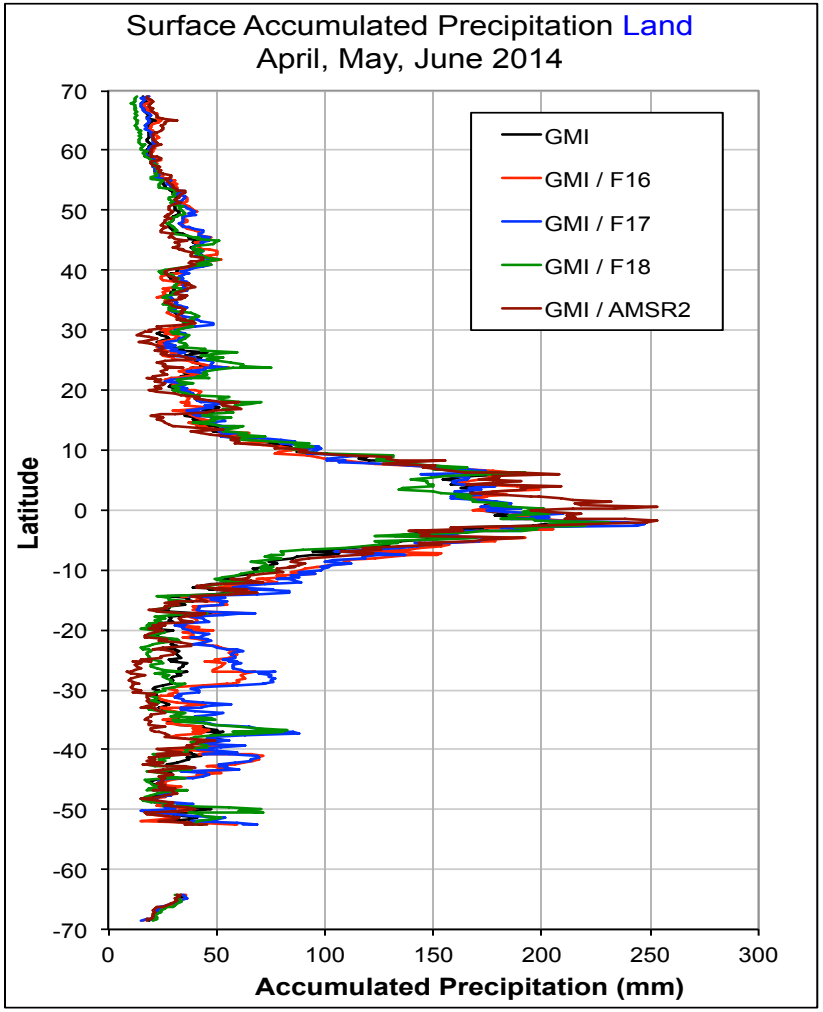


GPROF V1.4
Zonal Means - Land

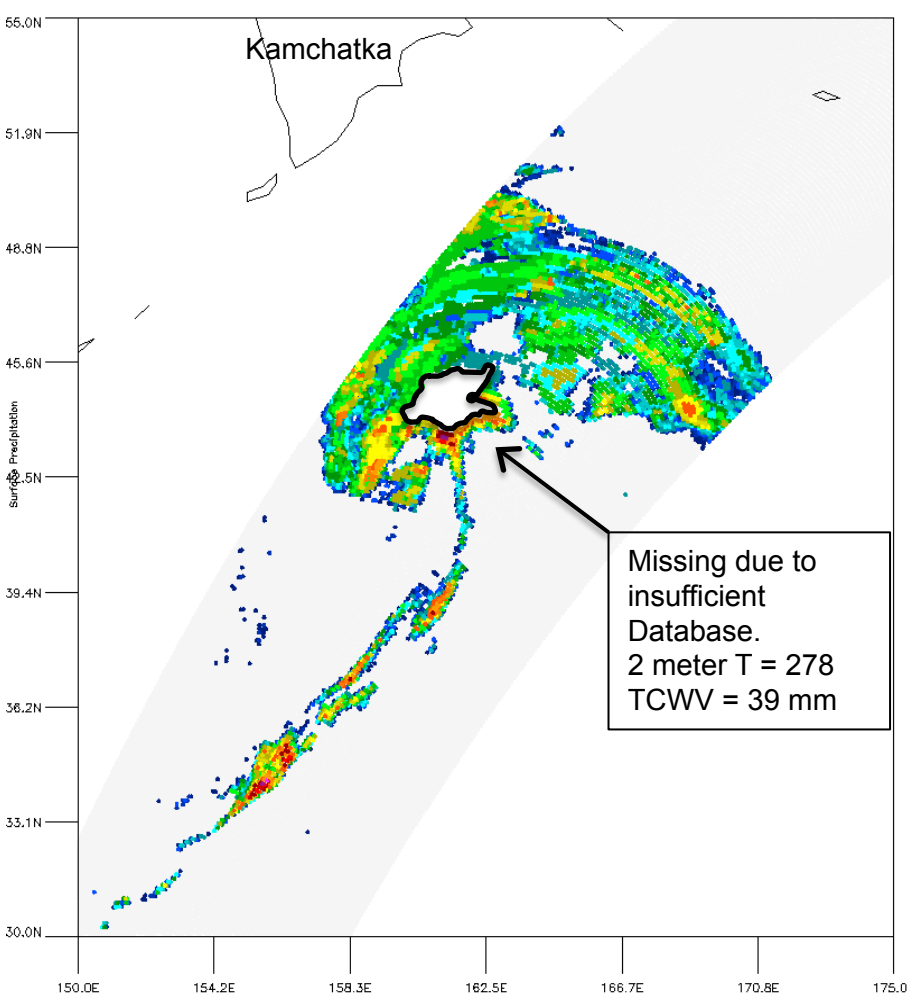
All Pixels

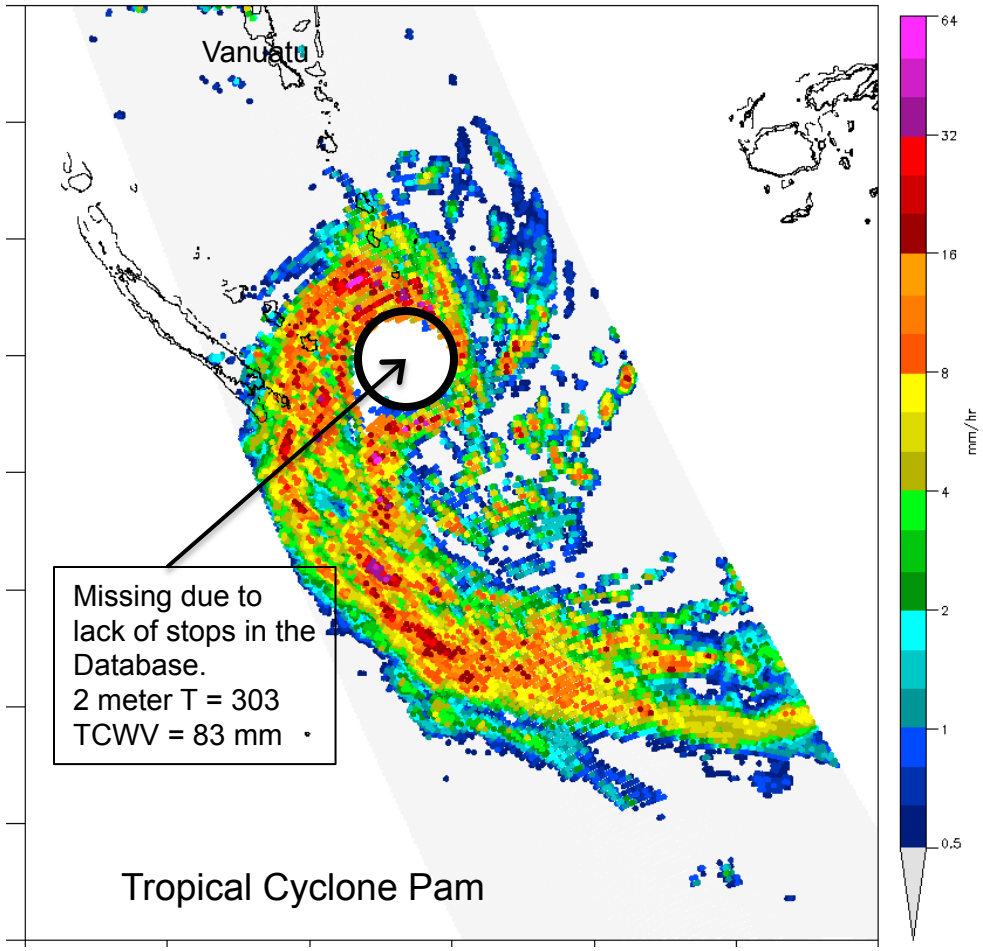


Matched Diurnal Sampling

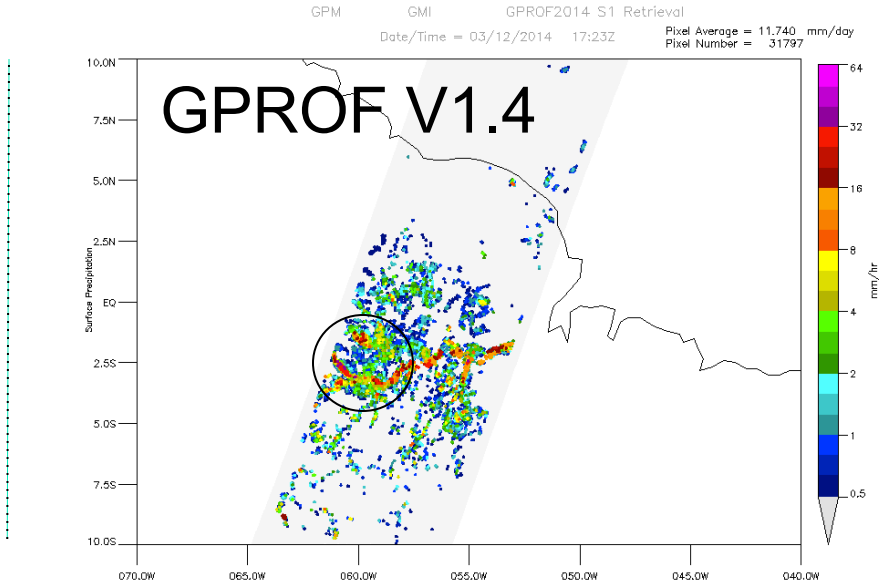


GPROF V1.4 - Missing pixels

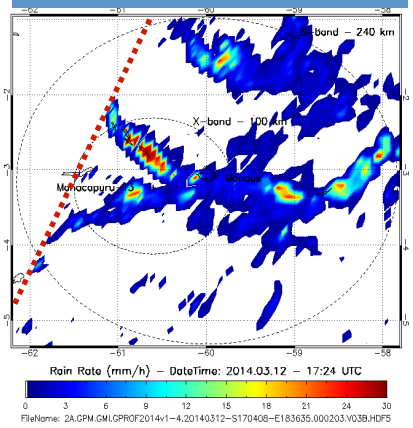




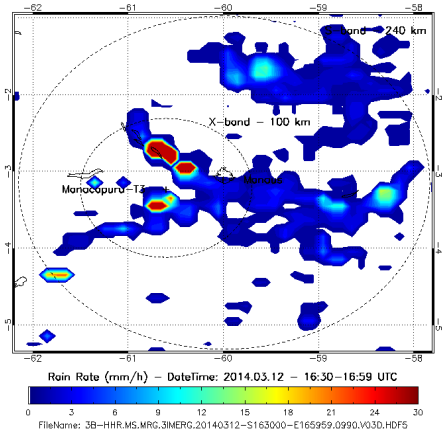
GPROF V1.4 vs V2.Empirical

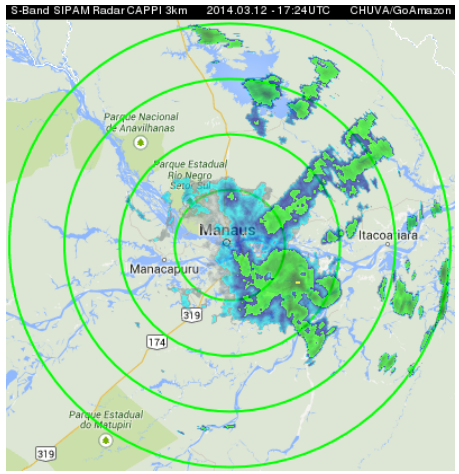


GPROF v1-4



IMERG HHR - V03D





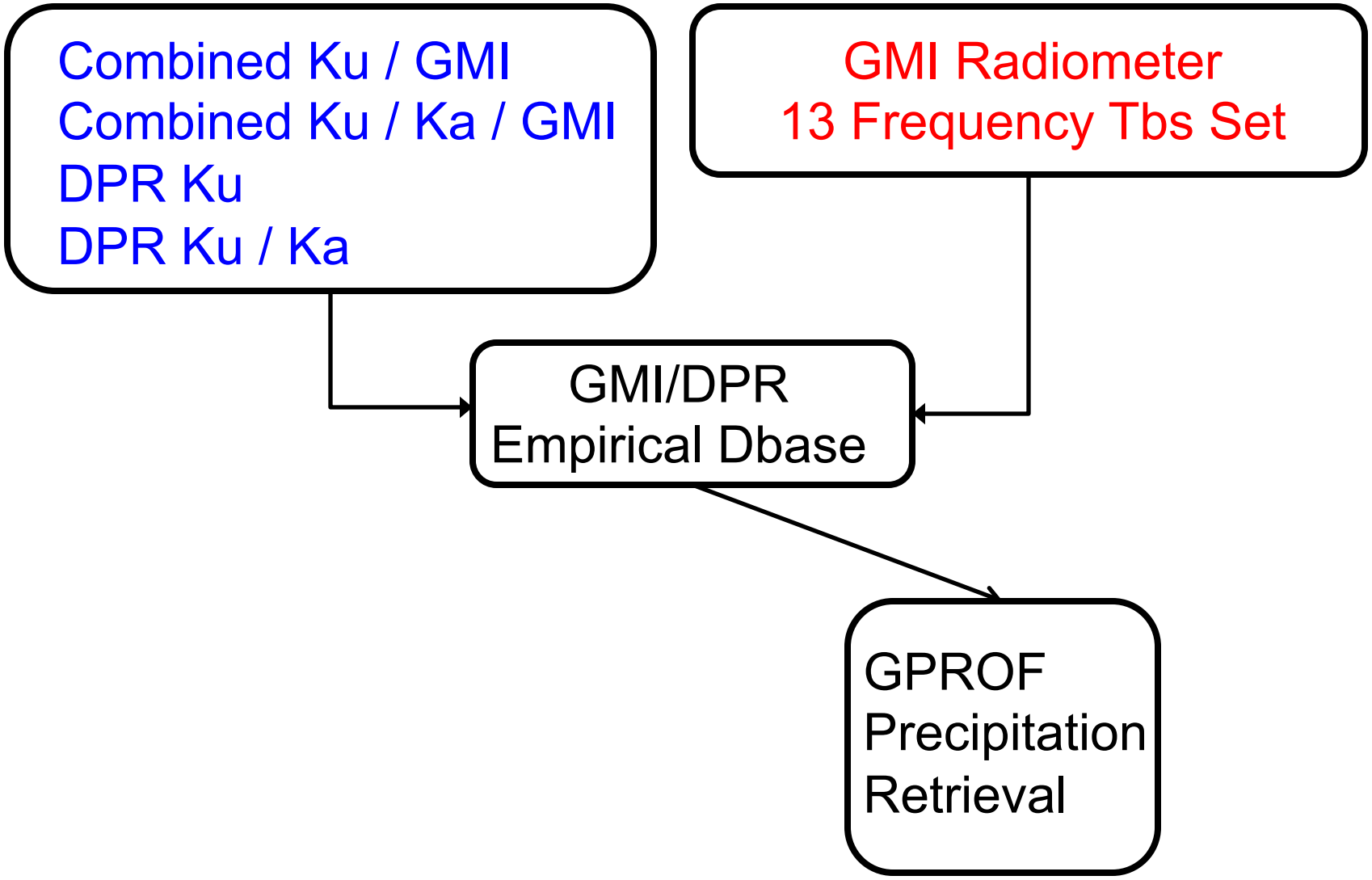
GPROF Version Numbers

- **GPROF V1.1 – V1.4: At launch algorithm**
  Uses a combination of TRMM oceanic database with empirical land databases from MRMS & CloudSat + assumptions for high latitude. "The Evolution of the Goddard Profiling Algorithm to a Fully Parametric Scheme", *J. Atmos. Oceanic Tech*., in final revision.

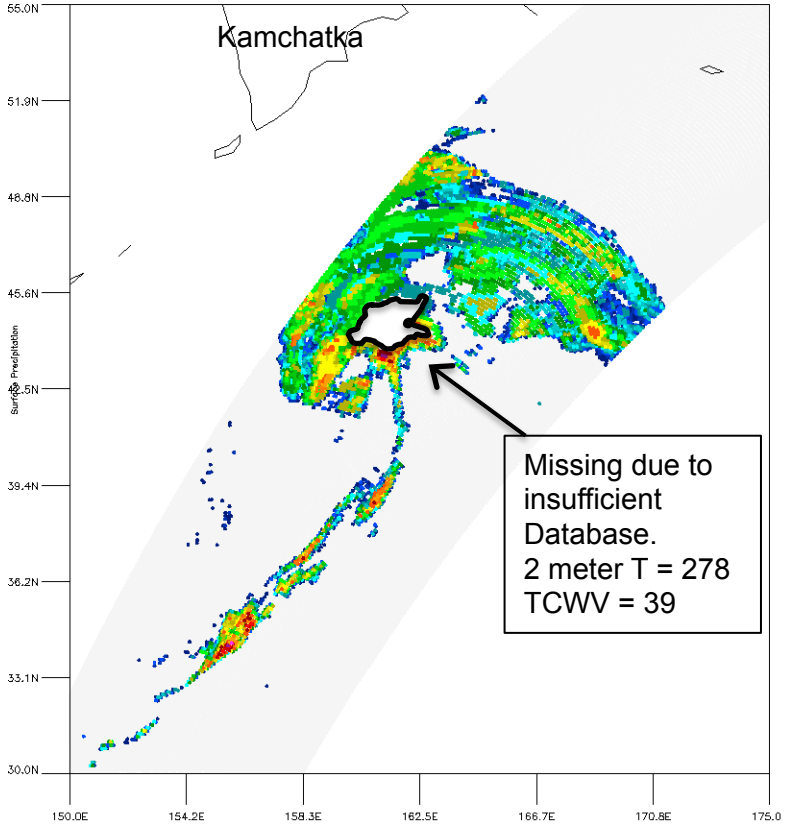
- **GPROF V2.Empirical: Will never be released**
  Used for testing of GPROF 2.0 algorithm with a database applicable to GMI only. Database uses PR or Combined as "truth" matched to observed GMI Tb

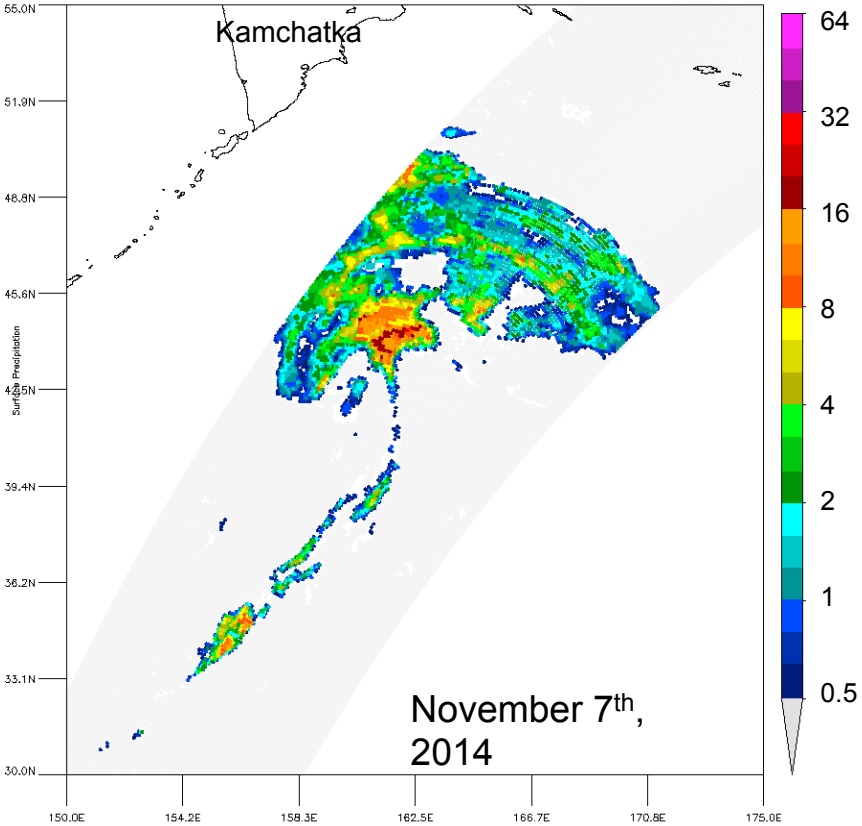
- **GPROF V2.0: First true GPM database**
  Uses GPM Combined product plus forward model for database generation. In development. No results available yet, but should be very similar to V2.Empirical for GMI

GPM V2.Empirical Database



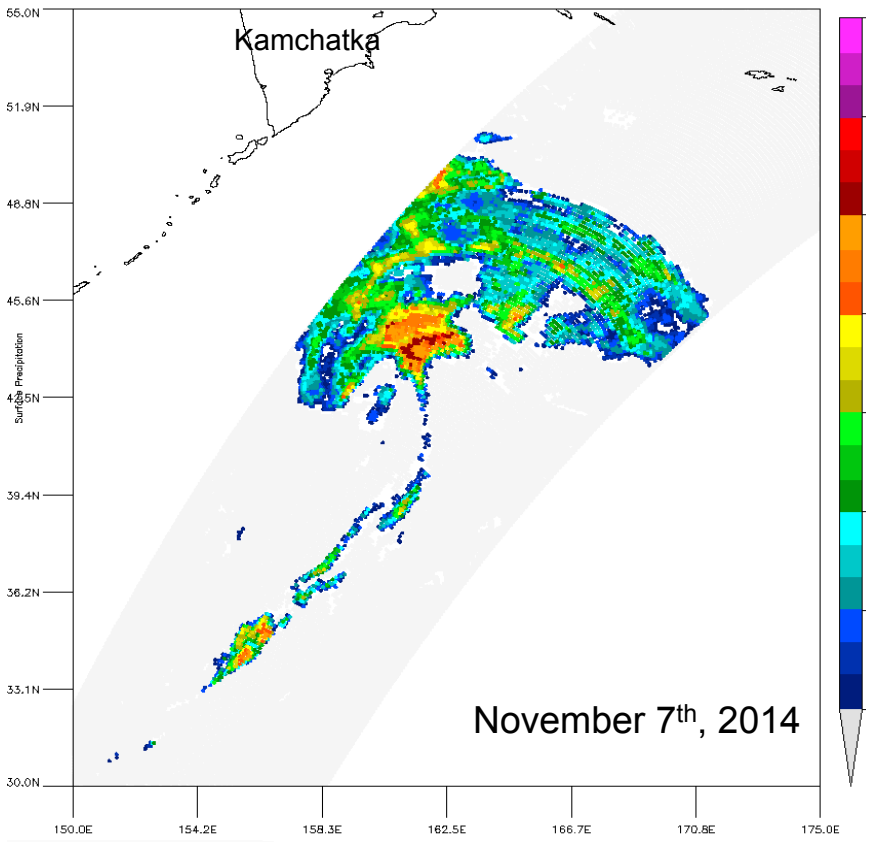
GPROF V1.4 vs V2.Empirical



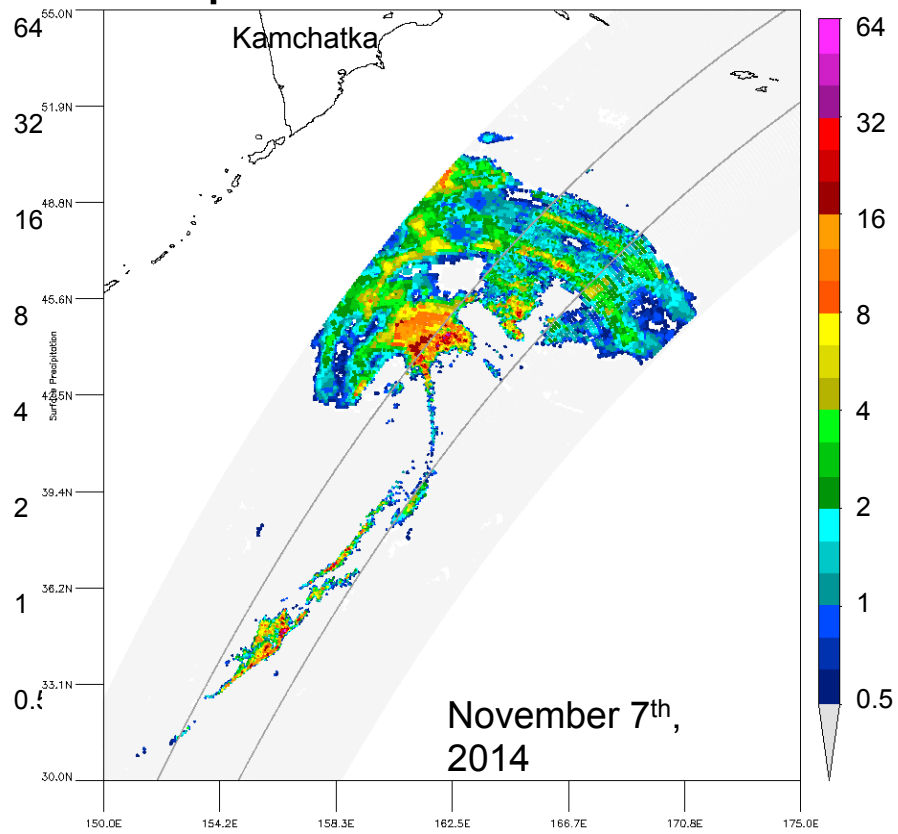


GPROF V2.Empirical

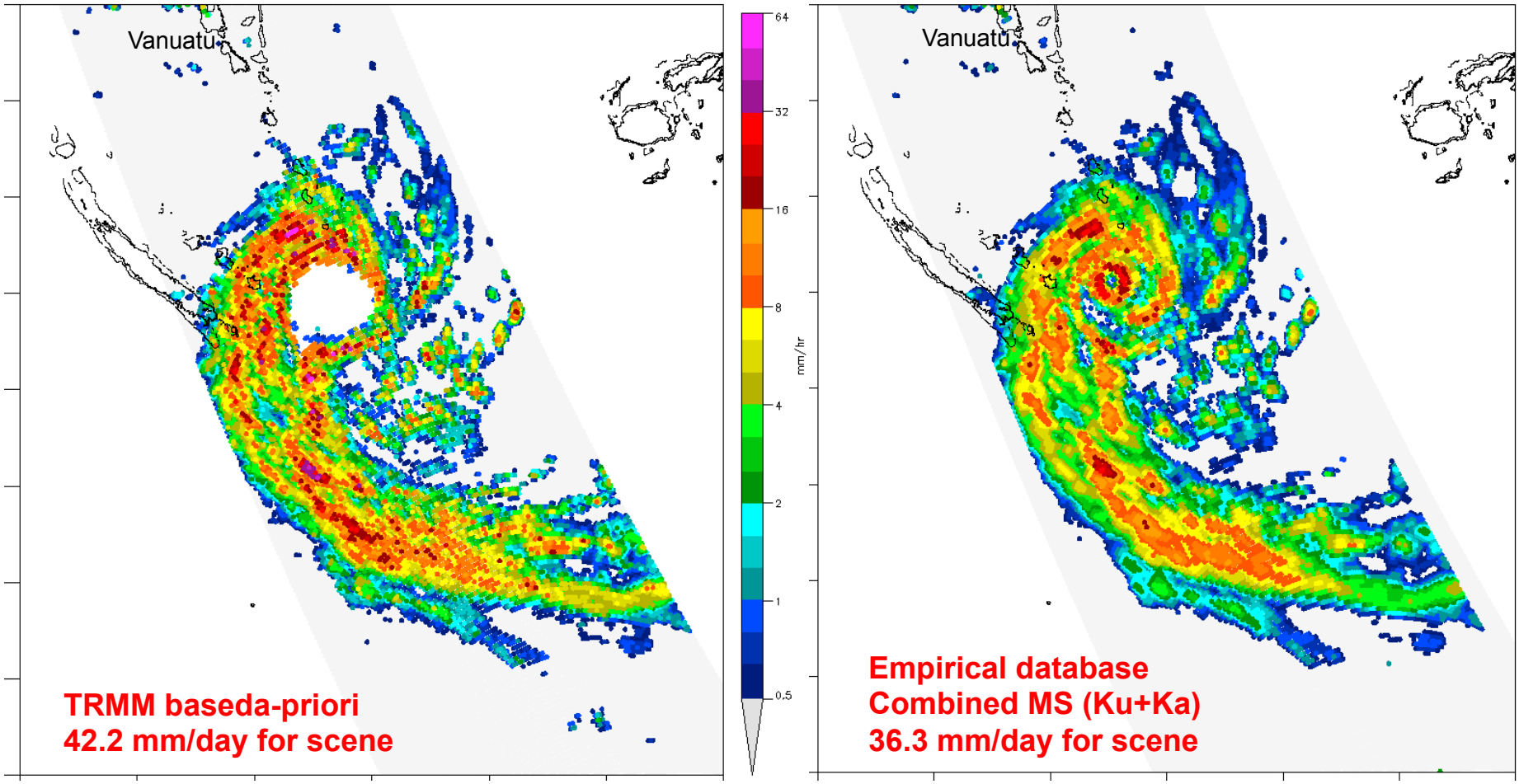
GMI



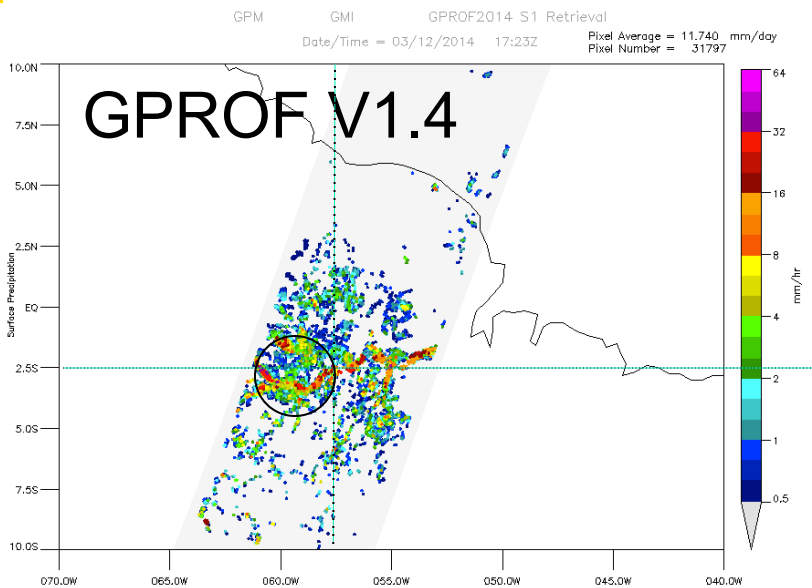
Precipitation GMI + Comb MS

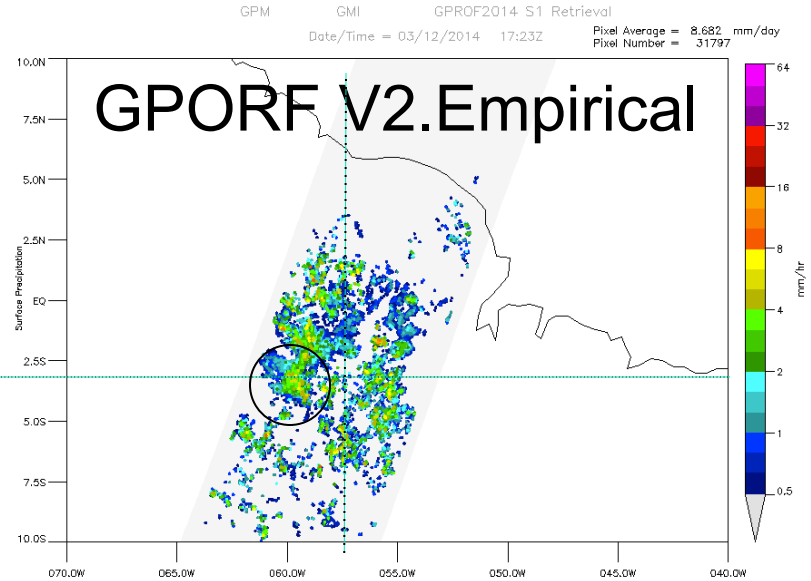


GPROF V1.4 *vs* V2.Empirical

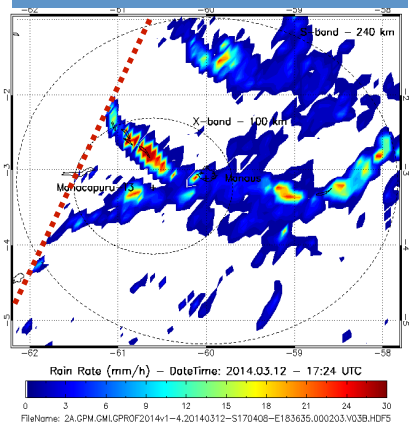


GPROF V1.4 vs V2.Empirical

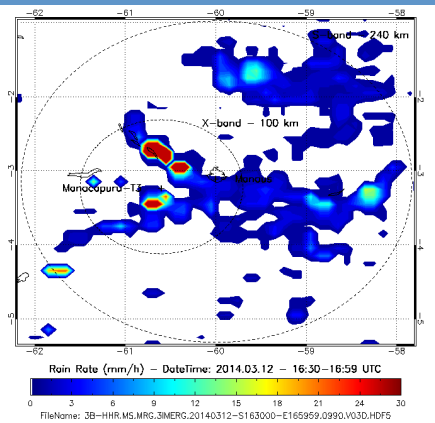


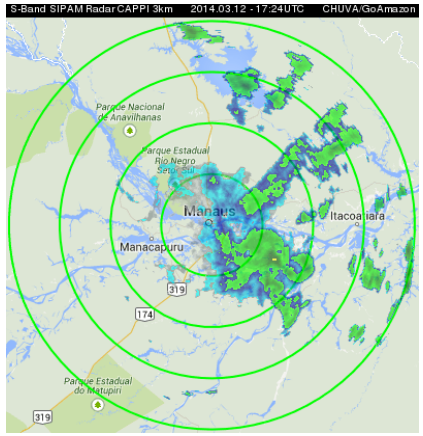


GPROF v1-4



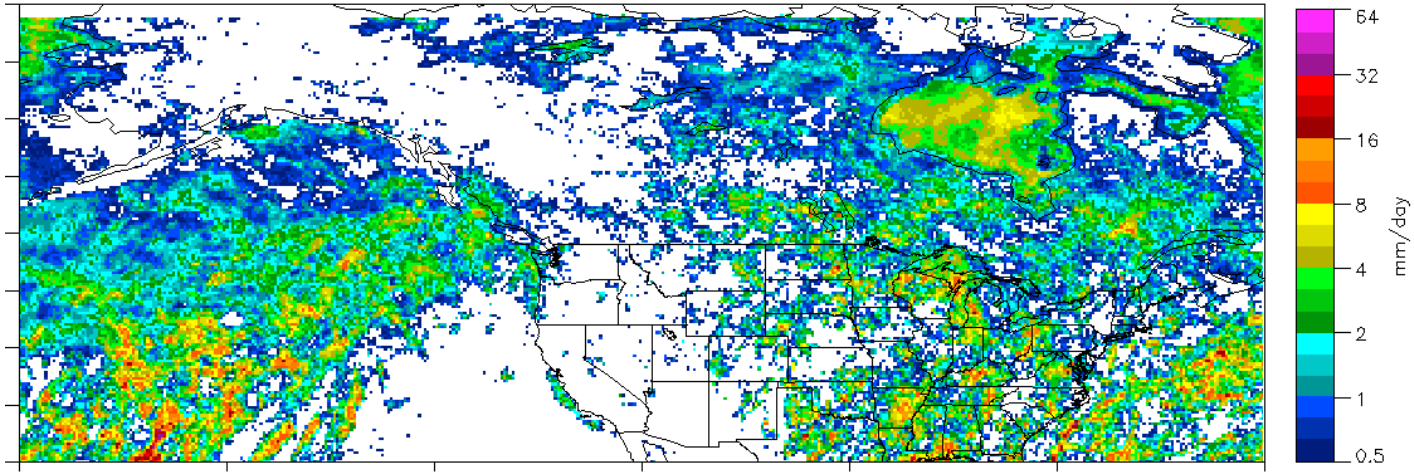
IMERG HHR - V03D



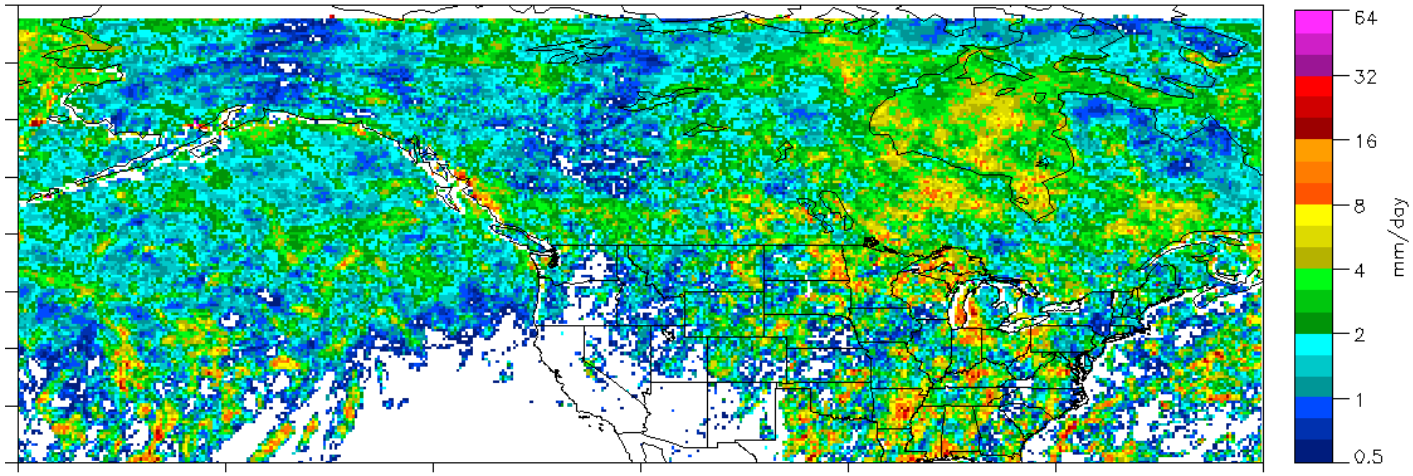


GPM Radiometer Retrieval - April, 2014

V1.4

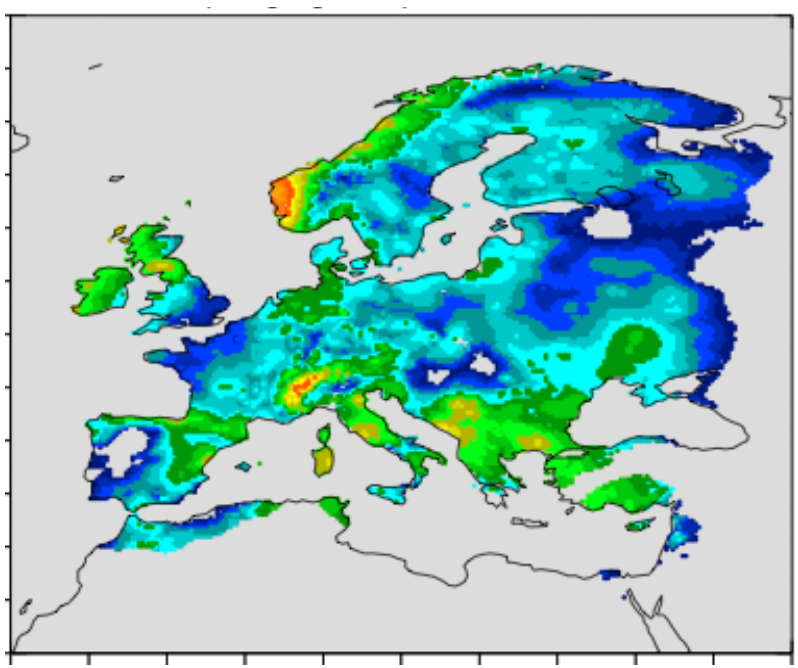


V2.Empirical

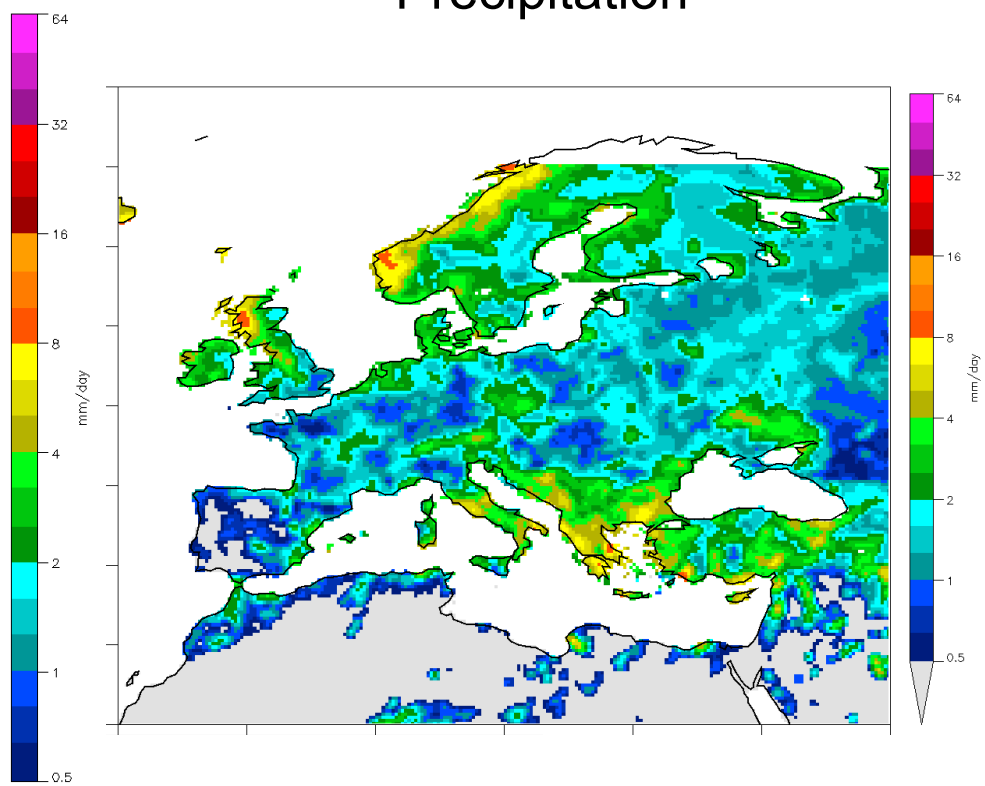


GPROF Comparisons w. Sfc Gauges

E-OBS European Gauge
March 2015 Average
Precipitation



V2.Empirical – Combined NS
March 2015 Average
Precipitation



Next Steps

Finish and integrate new Database to accommodates constellation radiometers.

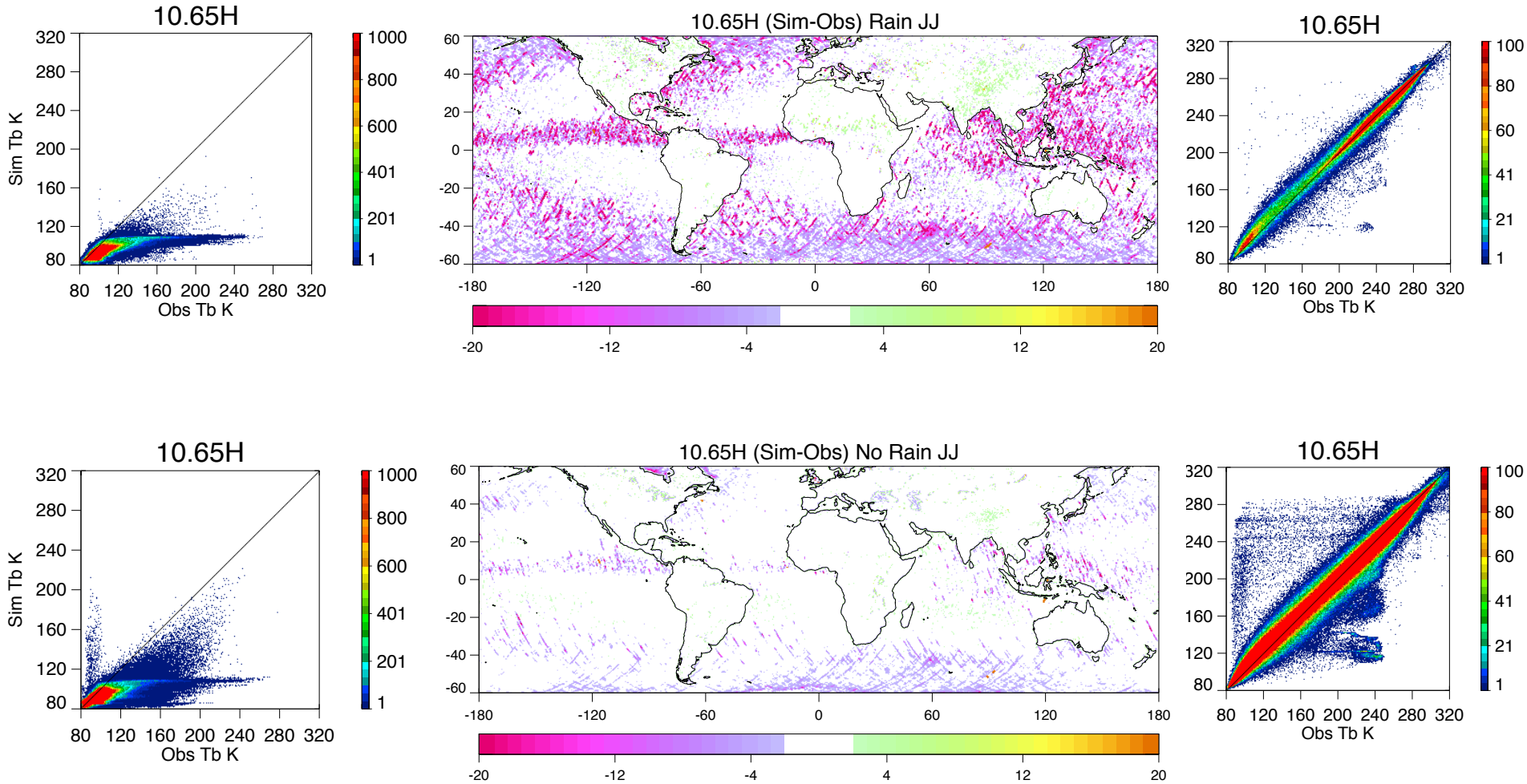
Integrate Sounding Radiometers to use the Combined Product for its database

Continue developing S0 and S2 retrievals. S2, in particular, is important for synergy with snow and soil moisture.

Continue working on uncertainties.

GPROF V2.0
(V2.Empirical + physical database)

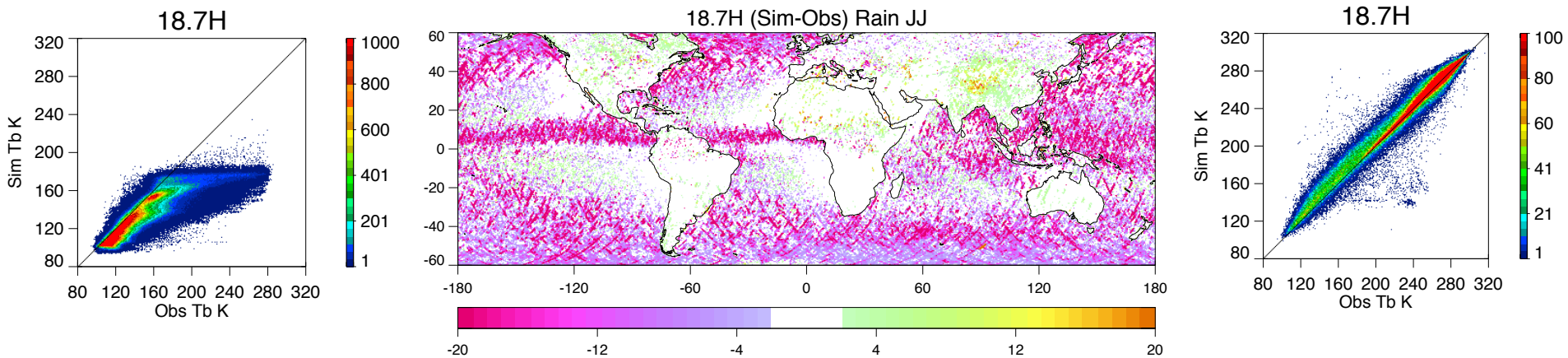
10.65 GHz – H pol

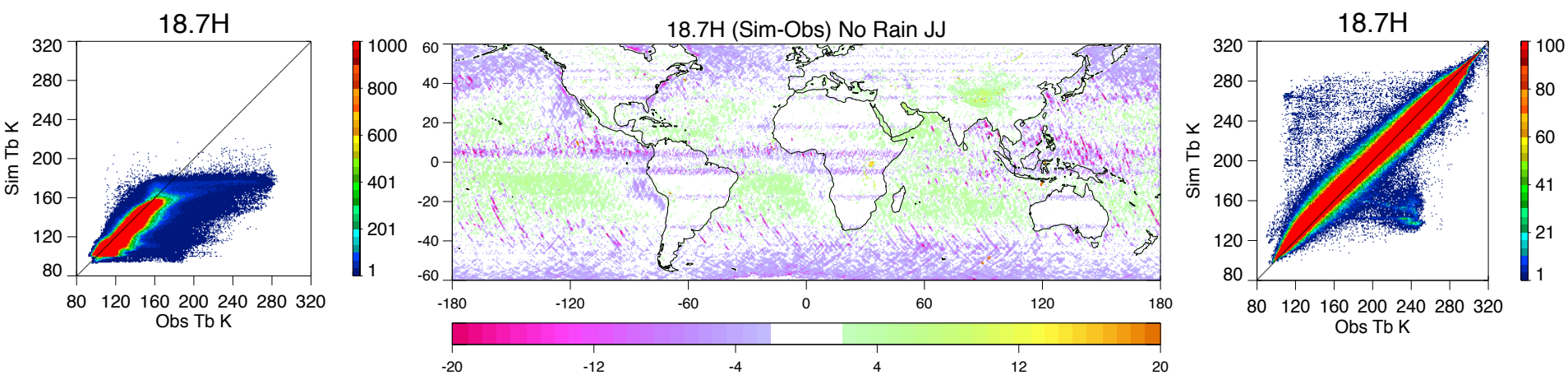


Ocean

Land/Snow/Ice

18.7 GHz – H pol

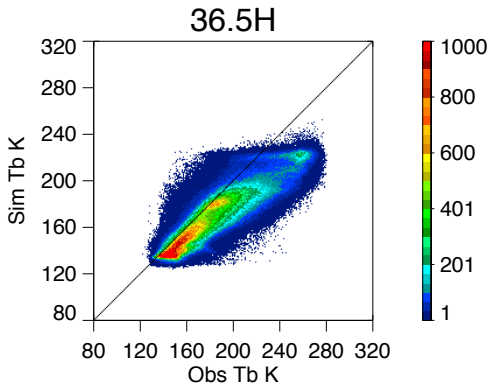


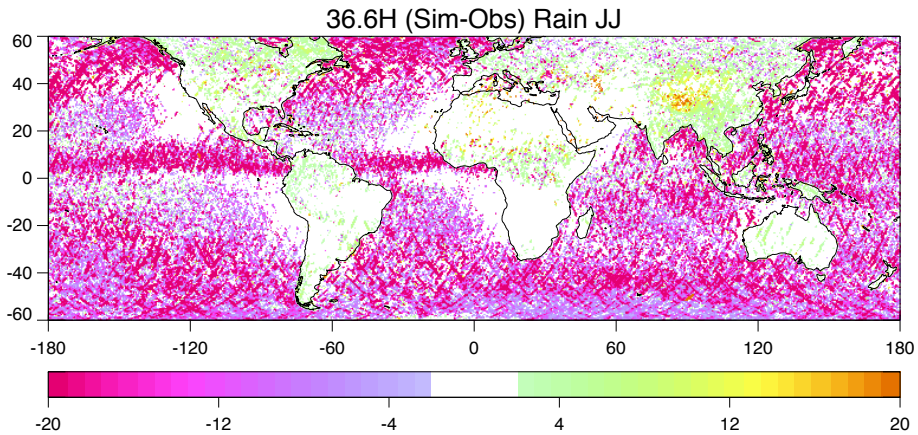


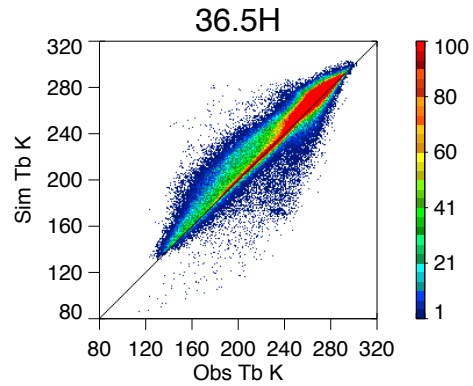
Ocean

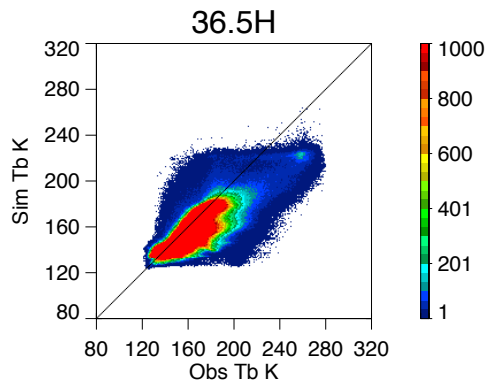
Land/Snow/Ice

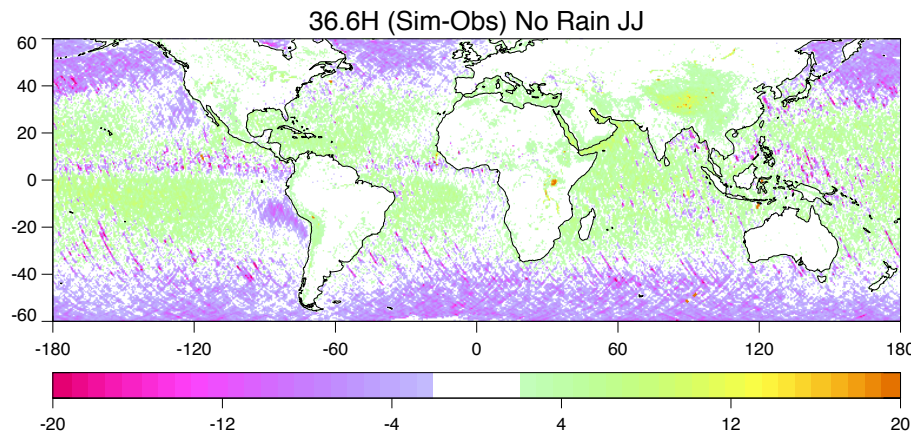
36.6 GHz – H pol

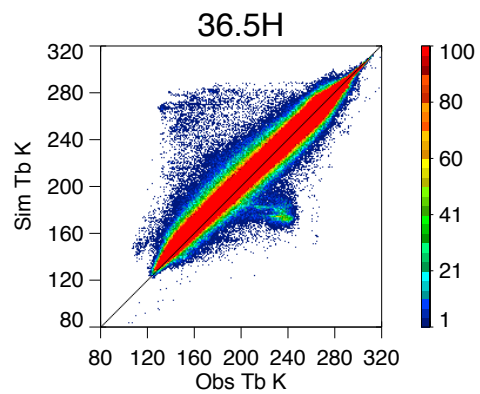








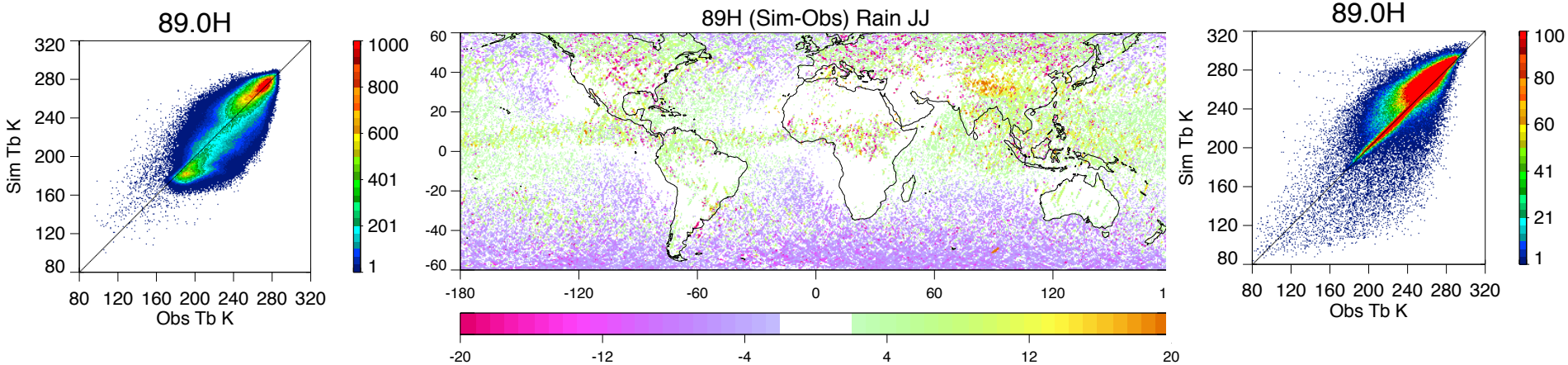


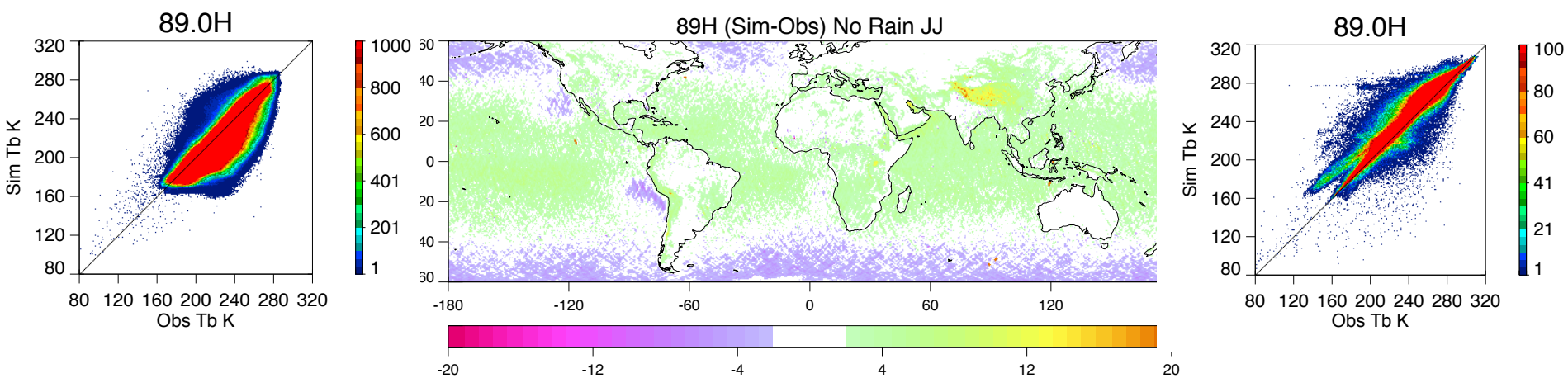


Ocean

Land/Snow/Ice

89 GHz – H pol

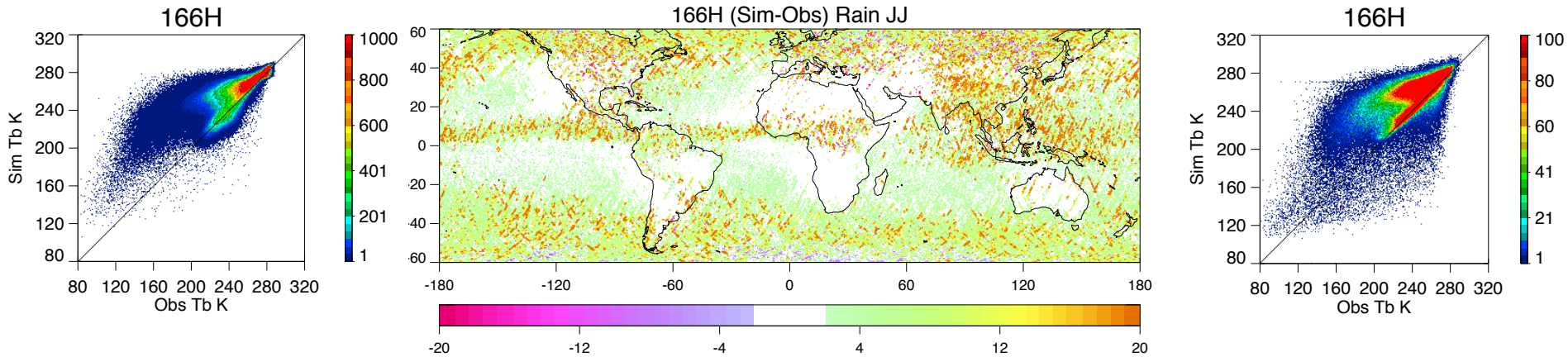


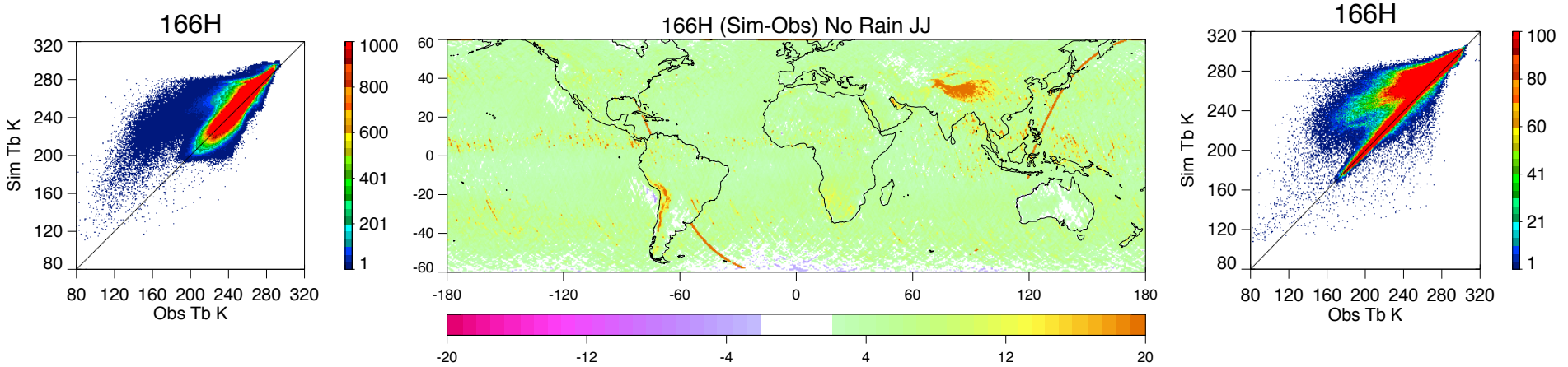


Ocean

Land/Snow/Ice

166 GHz – H pol

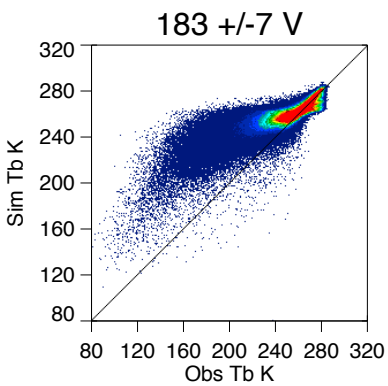


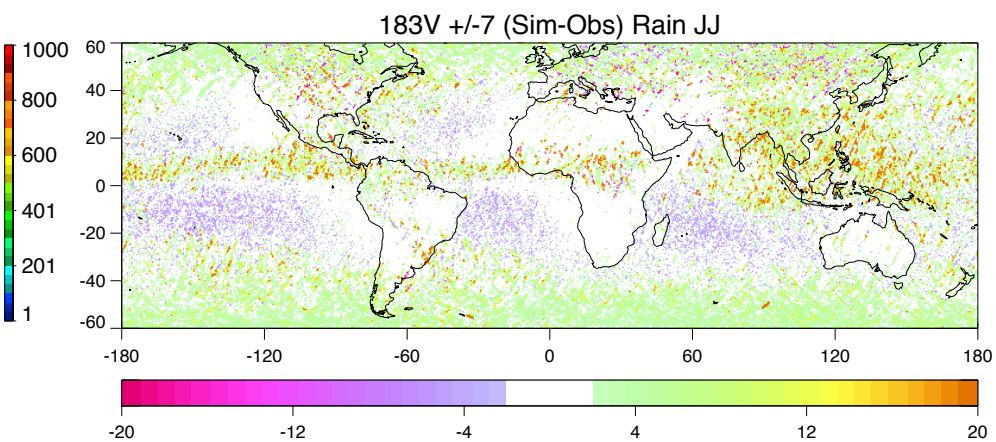


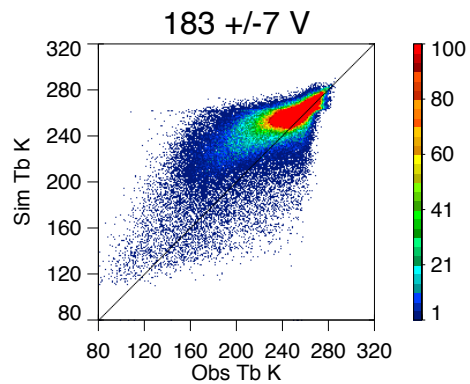
Ocean

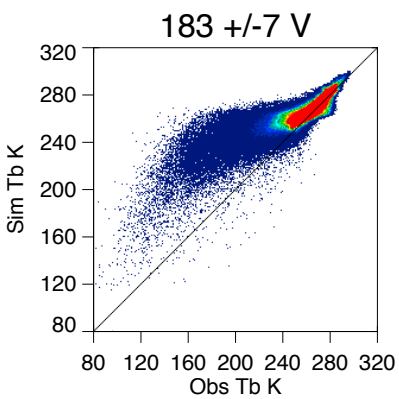
Land/Snow/Ice

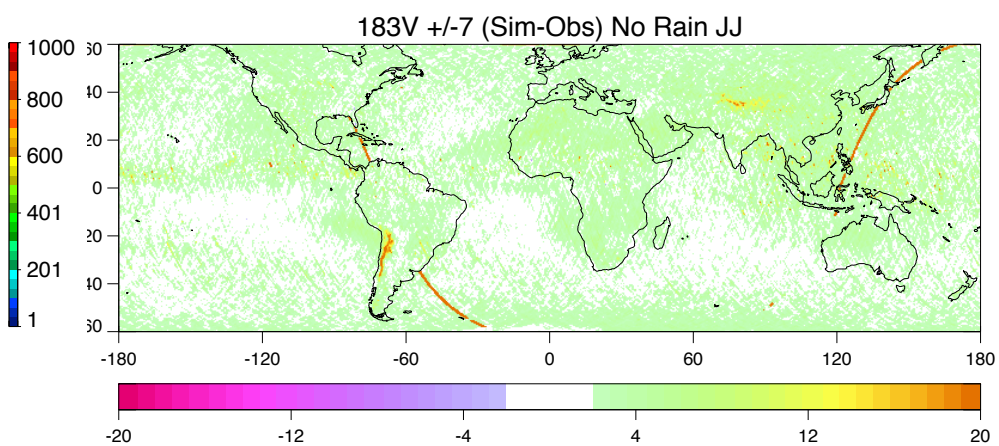
183±7 GHz – V pol

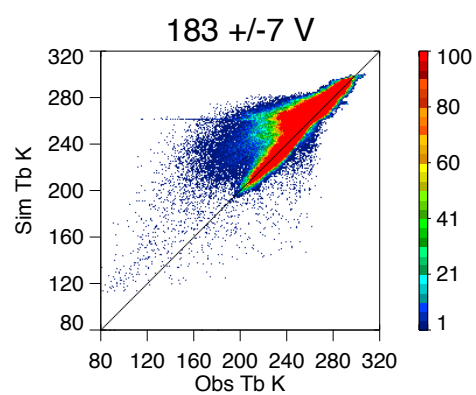








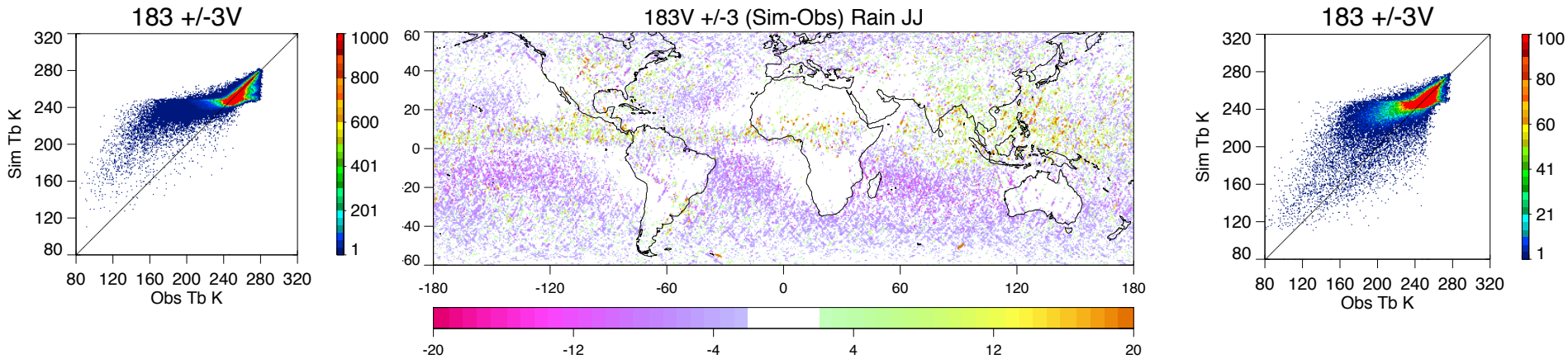


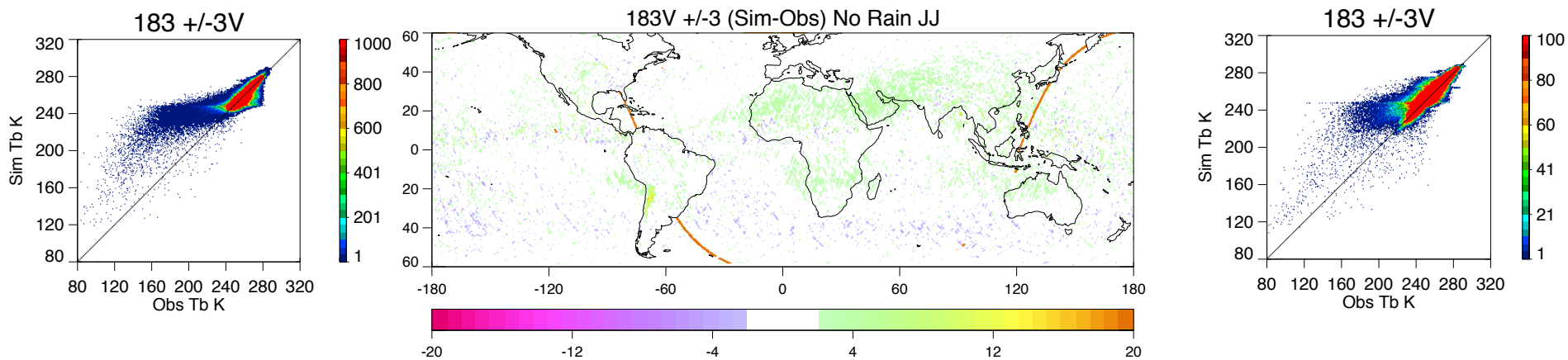


Ocean

Land/Snow/Ice

183±3 GHz – V pol





Ocean

Land/Snow/Ice